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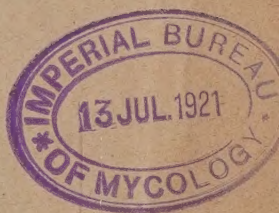
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IOWA AGRICULTURAL COLLEGE

EXPERIMENT STATION,

AMES, IOWA.

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THE ASPARAGUS RUST IN IOWA.

L. H. DAMMEL & E. R. HODSON.

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## The Asparagus Rust in Iowa.

L. H. PAMMEL.

E. R. HODSON.

During the summer our attention was called to the appearance of Asparagus Rust on Muscatine Island by Mrs. Alice Walton Beatty. Early in September the rust was found in considerable quantities in one of the asparagus beds on the college farm; since then it has been observed at many points by ourselves and Mr. M. Cumming, in and about Ames. It was also reported to us from McBride, Iowa, by Mr. H. A. Mueller, in September, 1900, as being abundant at that place and at Mt. Pleasant by Mr. E. E. Hodson.

Miss Mary C. Rolfs, of Hampton, Iowa, wrote October 28th, in response to an inquiry concerning the rust: "I have looked at two beds of asparagus, one a small bed where the tops of the bushes have not been cut, the other bed had been trimmed or cut some time ago. In the uncut bed I found one large plant much covered with the disease. I send you the plant in separate package. In the same bed I found about five or six other plants affected near the base of the stalk. This stalk which I send you was bent and seemed to be covered by the other bushes. I notice that those affected seemed to be near the center of the bed where the sun and air do not reach the stalk. In the other bed, that was cut, I found but few plants that were slightly diseased. Mr. Ferris, the nursery man, says he always cuts the tops in the early or middle fall."

In several instances the writers have observed that this fungus is much more abundant in one edge of the asparagus bed than in the center. In one bed the south end of the rows were affected. The plants alongside of houses or near trees seem to be less affected than in the open. In one case, but a few rods distant, the plants on the south side of a house showed no rust whatever while the plants in the open field were covered with the fungus.

It has been so destructive in many of the eastern states and in Europe that a short account and the methods of prevention will not be amiss at this time. The occurrence of the fungus in Iowa this season is interesting as showing how the fungus spreads from year to year. The first general account of its occurrence in this country and its destructiveness was made by Dr. Halsted.<sup>1</sup> Drs. Harkness and Moore mention it in a catalogue of the Pacific Coast Fungi, but no specimen was preserved. Early in September of 1896 the asparagus growers complained about the premature maturing of their asparagus fields. In a letter to L. F. Kinney,<sup>2</sup> Dr. Halsted stated that in that year it was limited to New England, Long Island, New Jersey, Delaware and Maryland. In 1897 it had extended to South Carolina,<sup>3</sup> and accounts of its continued destructiveness appeared in reports of the Rhode Island,<sup>2</sup> Massachusetts,<sup>4</sup> Vermont<sup>5</sup> and Maryland<sup>6</sup> experiment stations. The fungus has been known to mycologists for some time. DeCandolle<sup>8</sup> described the fungus in his work on French plants in 1805. The cluster cup stage<sup>8</sup> was described by Lasch. The *Uredo*<sup>9</sup> was described by the same author in 1848.

It has been referred to by European mycologists like Schroeter,<sup>10</sup> Frank,<sup>11</sup> Sorauer,<sup>12</sup> Comes,<sup>13</sup> Sajo,<sup>14</sup> Tubeuf,<sup>15</sup> Winter<sup>16</sup> and Saccardo.<sup>17</sup> It is plain from the references here given that this fungus has spread quite rapidly in this country during the last four years. In 1899 it had made its appearance in Illinois according to trustworthy accounts. In a letter to us from a trustworthy correspondent in central Illinois the statement was made that it was common and destructive last year in Illinois. Its sudden and abundant appearance in central Iowa would lead us to suppose it must have existed in Iowa during the previous year but not reported. The present season has been so favorable for the spread of the fungus in central Iowa that a few infected plants early in the season, no doubt, has done much to cause the general infection in this state. There has been an unusual amount of rain all through the growing season and this abundance of moisture coupled with high temperature has furnished ideal conditions for rust.

Exsiccati: Fuckel, Fung. rhen. 378. Rabenhorst, Herb. Mycol. 680. Rabenhorst, Fung. Europ. 394. Thumen, Mycoth Univ. 432. 834.



In order to bring the matter before the people of the state, press notices were sent to the Iowa State Register,<sup>18</sup> Wallace's Farmer,<sup>19</sup> and the Homestead.<sup>20</sup> In response to these notices Mr. H. A. Mueller of McBride, Iowa, wrote as follows: "At your request through Wallace's Farmer,<sup>21</sup> I send you some asparagus branches. The most of it is dead with the exception of some young growth."

**GENERAL APPEARANCE.** The general tendency of rusted plants is to become prematurely yellow, instead of the usual healthy green color. Thus early in September the plants were yellow and the leaves were beginning to fall; a somewhat closer inspection indicated that the stem was blistered, due to the rupturing of the epidermis where the sori or spots of the fungus occurred.

**CHARACTER OF THE FUNGUS.** The small spots or sori contain the summer spores or uredo spores, which are brown. These spores are one-celled and smooth. European mycologists describe an earlier stage, the *æcidium* or cluster cup fungus, in which the spores are borne in chains in a cup. This stage has not been found in this state but it has been found and described by Dr. Halsted as occurring in New Jersey. It is common in Europe. The third stage or winter form technically known as the teleuto stage occurs later; it was abundant during the latter part of September. The spores are two-celled and attached to a permanent stalk. These spores come from the same mycelium that produced the summer spores. The mycelium or vegetative part of the fungus develops in the interior of its host, taking its nourishment from the asparagus, hence the turning yellow and the premature falling of the leaves.

Dr. Halsted finds that the uredo form is frequently associated with the *æcidia*. In this case the uredo sori are near to, but outside, the oval orange area filled with cups and spermatogonia. It is of great importance to notice that the *æcidium* stage was found only upon early plants which were not molested, and produced brush before the regular plants had appeared. The conclusion seems to be that the cluster cup stage must form early or not at all. If the cluster cup is necessary, a means of prevention of the rust is suggested here.

According to the observations of Dr. Halsted<sup>1</sup> the three stages occur upon the same host in this country. He found the *æcidium* stage as early as June 3rd. Close examination



FIGURE I—General appearance of *Asparagus rust* 1. Aecidium or cluster cup stage 2. Spores shown at 3. Uredo sorus and uredo spores at 4 and 5. Teleuto sorus at 6. Teleuto spores at 7. (1, King, the other figures after Halsted.)

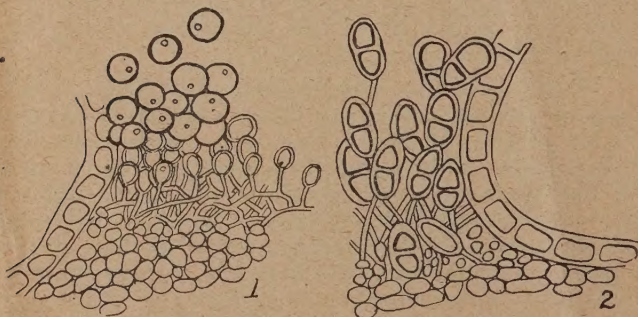


FIGURE II—1. Uredo sorus with spores and mycelium. 2. Teleuto sorus and teleuto spores and mycelium. (After Halsted.)



shows that the æcidium cups are in oval clusters.\* In many of the sori of this stage the cups formed the border while the center was made up of spermagonia. The spermagonia may be distinguished by their small size and the watery appearance they give to the sori.

HOSTS. *Puccinia Asparagi* has been found upon four species of asparagus, *A. officinalis*, *A. maritimus*, and *A. verticillatus*. Dr. Halsted has examined many specimens of the ornamental species, *A. scandens* and *A. plumosus*, but has failed to find the rust. Another rust, *Puccinia phyllocladia*, Cke., is recorded upon *Asparagus falcatus*; this however seems to occur only in Africa.

FUNGUS ENEMIES OF THIS RUST. There is a parasitic fungus, (*Darluca filum*), which preys on the rust. This fungus has much smaller colorless and more delicate spores than the rust and is more susceptible to the spray of the fungicide. So that spraying may defeat its own end. The spores of the *Darluca* occur in black pycnidia which by their great number give to the sori of the rust a black appearance. *Darluca filum* is a fungus affecting a large number of the Uredineae and does much to prevent the ravages of rusts. It is common this year on corn rust (*Puccinia Maydis*) in this vicinity.

Besides the *Darluca filum* another fungus *Tubercularia persicina* is found to live upon the cluster cup stage, and if this stage is essential for the development of the rust, this parasite may do much to check it. This fungus would not be injured by spraying as the cluster cup grows upon old stalks in out of the way places. This fungus is easily recognized by its purple color.

PREVENTATIVE MEASURES. As the mycelium of the fungus works in the interior of the plant, nothing will destroy the fungus when once the mycelium has entered its host, so that all measures for treatment must be preventative.

According to Dr. Halsted<sup>1</sup> there is a slight decrease of rust in spraying with Bordeaux mixture. He experimented with eight plots,—four sprayed and four not sprayed, as checks. The sprayed plots averaged 55.10 per cent, while those of the checks averaged 74.8 per cent, the gain being 19.7 per cent. Figuring the unsprayed plot as 100 per cent, the decrease by spraying is more than one-quarter.

There is no variety free from the rust, although European growers claim that the Yellow Burgundy is practically rust-

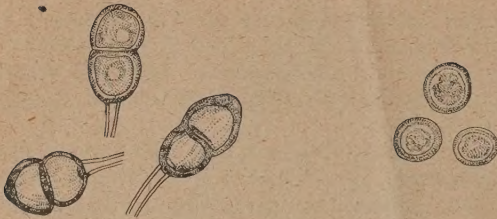


FIGURE III—Uredo spores at the right ; telento spores at the left. (King.)

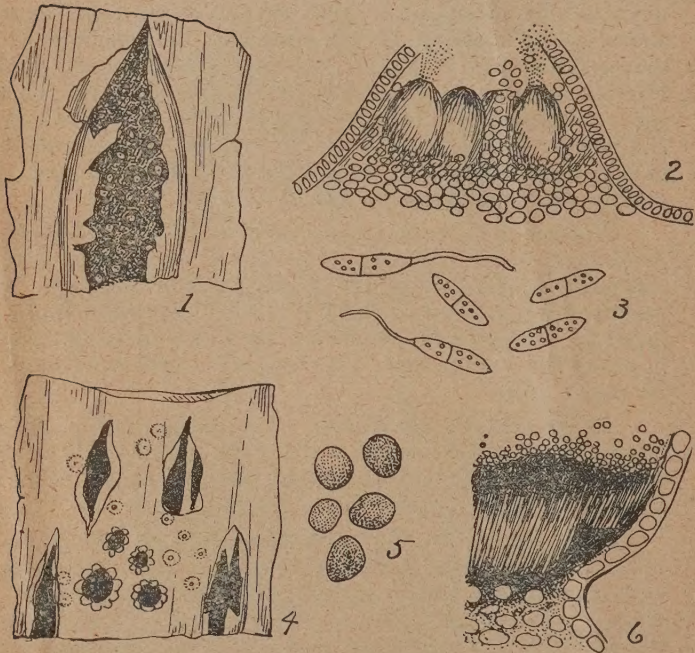


FIGURE IV—1, 2 and 3 *Darluca filum*. 1. Infected sorus 2. Cross section showing pycnidia and spores. 3. Spores magnified two showing germ tubes. 4, 5 and 6. *Tubercularia persicina*. 4. Parasite in sorus of rust. 5. Spores of parasite magnified. 6. Section through sorus, showing parasite with spores. (After Halsted.)



proof. The Palmetto is markedly lower than the rest of the American varieties.

The best method of prevention undoubtedly is to clean up all rubbish in the fall and burn it. This will destroy many of the teleuto spores, which carry the rust through the winter. And also keep down all volunteer plants in the corners, as the æcidia develop on these. This stage has not been proven absolutely essential to carrying the rust over from one season to another but probably it has something to do with keeping up its energy and it is therefore a good plan to keep this stage down.

C. Sajo<sup>15</sup> in writing on the asparagus, notes the remarkable freedom from the rust of the wild asparagus and thinks that this is perhaps not due to the greater resistance but to the fact that it is more scattering and is not so easily infected as the asparagus in beds. Miss Rolf's observation plainly indicates that it spreads from a center of infection. Neither fertilizers nor methods of cultivation seem to have any effect upon the occurrence of the rust.

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